CrossFire™ IX

CANopen Slave Developers Guide

crosscontrol
www.crosscontrol.com

Contents

1. Introduction

1.1. Background

The CrossFire™ IX is a CAN bus node, and by configuring the node properties, the module can be set up to automatically send and receive I/O to and from the CAN bus network.

The CrossFire™ IX supports the CANopen protocol that is one of the leading protocols used in CAN bus networks.

This document describes how the CrossFire™ IX CANopen slave should be used. The reader is supposed to be familiar with the CANopen standard in order to fully understand the manual.

Overview:

- The CrossFire™ IX supports the CANopen protocol.
- The CrossFire™ IX is implemented in accordance with CANopen application layer and communication profile CiA 301 and Device profile for generic I/O modules CiA 401.
- The CrossFire™ IX implements all CiA 301 mandatory objects.
- The CrossFire™ IX has a default baud rate of 250 kbits/s.
- The CrossFire™ IX supports CANopen heartbeat consumer and producer and also node guarding.
- The CrossFire™ IX is a CANopen NMT slave device.
- The CrossFire™ IX implements many CiA 301 optional objects, for details, see chapter 3.1: Communication Profile Area, Part1, Index 0x1000 to 0x11FF.
- The CrossFire™ IX supports CANopen SYNC message consumer and producer.

1.2. References

CAN in Automation - CANopen standard: http://www.can-cia.org

1.3. History

Rev	Date	Author	Changes
0.9	2017-06-29	Carl-Magnus Moon	First version
1.0	2017-10-31	Joakim O'Nils	Updates for the 1.0 BETA SW version
1.1	2017-12-01	Carl-Magnus Moon	Updates for the 1.0 SW version
1.2	2017-12-21	Carl-Magnus Moon	Minor corrections and clarifications

2. CANopen Slave

2.1. Port Overview

The CrossFire™ IX is highly configurable. The configuration can be changed by writing to the object dictionary in the Manufacturer-Specific Profile Area (0x2000 to 0x5FFF).

2.1.1. Node Id Interface

The node id is configurable via the digital IO inputs or from software.

- The node id is set in the start-up phase and cannot be altered during runtime, (a reboot is required after the node id is changed).
- The software node id is configurable in the object dictionary (index 0x2010).
- The software node id range is 0-127, where:
  - 0 => id is read and set from HW pins.
  - 1-127 => id is set from SW, (overrides HW pins).
- The default software node id is 1.
- There is a bit mask in object dictionary index 0x2031 where it is possible to decide which digital inputs will affect the node id. Bits set to 0 in this mask will not affect the node id. Bits set to 1 will affect the node id and also pull up will be automatically selected for the corresponding digital input.

Hardware ID pins Lookup Table

CANopen node id	DI4	DI3	DI2	DI1
1	0	0	0	0
2	0	0	0	1
3	0	0	1	0
4	0	0	1	1
....				
16	1	1	1	1

- State 0 is reached by wiring corresponding id pin to GND.
- State 1 is reached by leaving corresponding id pin disconnected.

2.1.2. Input I/O

All of the Input I/O ports on the CrossFire™ IX are configured to "Not used" by default. They must therefore be configured in the object dictionary (index 0x2000) in order to be used.

Input 1-8 can be configured in the following modes:

- Not used
- Analog voltage input 0-10V
- Analog voltage input 0-32V
- Current input 4-20mA
- Digital input

Input 9-12 can be configured in the following modes:

- Not used
- Digital input

Input 13-14 can be configured in the following modes:

- Not used
- Digital input
- Encoder input [1]
- Frequency input

For each Input I/O port there are a bias setting available that makes it possible to activate pull up or pull down resistors. This setting can be configured in the object dictionary (index 0x2001).

For each Input I/O port it is also possible to adjust the sampling frequency (index 0x2038), the filter length (index 0x2036) and filter weight (index 0x2037). These settings can be adjusted to get faster or slower response for input changes.

2.1.3. Output I/O

All of the Output I/O ports on the CrossFire™ IX are configured to "Not used" by default. They must therefore be configured in the object dictionary (index 0x2002) in order to be used.

The Output 1-4 ports can be configured to the following modes:

- Not used
- PWM (regular pulse width modulation)
- Digital output

The Output 4-8 ports can be configured to the following modes:

- Not used

[1] Encoder input is available by combining frequency inputs 1 and 2.

- PWM (regular pulse width modulation)
- PWMi (current controlled pulse width modulation)
- Digital output

For each Output I/O port depending on the port configuration the following additional settings are available:

- PWM
  - PWM Frequency (object dictionary, index 0x2003).
- PWMi
  - Output Port Dither Frequency (object dictionary, index 0x2004).
  - Output Port Dither Amplitude (object dictionary, index 0x2005).
  - Output Port PID Regulator Settings
    - P – Proportional Value (object dictionary, index 0x2006).
    - I – Integral Value (object dictionary, index 0x2007).
    - D – Derivative Value (object dictionary, index 0x2008).
- Output 4-8 in digital out mode

  - The outputs designed for PWMi does not support capacitive load in hardware. For these outputs a specific soft-start mode can be activated to be able to drive small capacitive loads.
  - Soft start is performed using a high frequency PWM and by automatically ramping up the duty cycle according to the formula $y = \frac{A}{1024} \cdot e^{\frac{B}{255}x}$
  - A (object dictionary, index 0x2009).
  - B (object dictionary, index 0x200A).

  NOTE! As soft start uses a very high frequency PWM it might cause electrical disturbances and is only intended for test purposes.

Error detection differs a bit between outputs 1-4 and 5-8 due to the characteristics out the outputs.

For output 1-4, only a generic port error is signaled. Generic port errors include:

- Short to ground
- Short to battery
- Over temperature
- Inverse current
- Current Limitation (the drive circuit limits the current)
- Open load in off state

For output 1-4, open load in on state can be detected by the user by comparing the current feedback with the expected current.

For output 1-4 in digital mode, current limitation mode (the output driver limits the current to avoid overload) is allowed for 100ms. This makes it possible to use capacitive load with a high inrush current. When using PWM mode, current limitation mode is only allowed for a very short time.

For output 5-8 there are four types of errors available.

- Short to ground
- Thermal Warning
- Under Voltage Lock Out (UVLO)
- Over current

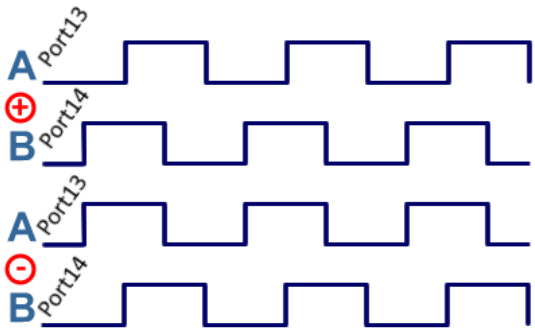
For output 5-8, open load in on state can be detected by the user by comparing the current feedback (OD 0x2016) with the expected current.

If a port error is detected the port is switched off. The port can be activated again by sending the retry after fault (OD 0x2012) command. A new start command must also be sent.

2.1.4. Encoder

The input ports of the CrossFire™ IX can be configured, OD 0x2000, to decode inputs from shaft encoders. Encoder input is available by combining frequency inputs 1 and 2 (Port13 and Port14). Decoding is performed in hardware.

There are two primary signals from an encoder, called A and B. By comparing the states of these two digital signals, magnitude and direction information are extracted.



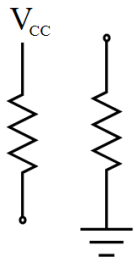
This information allows the CrossFire™ IX to either add or subtract subsequent pulses to a cumulative total which represents the shaft position. Shaft Position can often be handled as a relative value but it is also possible to reset the encoder value to 0 through the OD 0x2028.

When configured as Encoder (OD 0x2000_0D and OD 0x2000_0E), the analog input values (OD 0x6401_0D and OD 0x6401_0E) for both ports (Port13 and Port14) are combined to form the encoder value (32-bit). The 32-bit the encoder value is also transmitted on CAN in the TPDO4.

Both frequency input ports are configured if one of the port configuration values, OD 0x2000, are assigned to the encoder configuration.

When the frequency ports are configured for Encoder-signals the input-bias settings parameter, OD 0x2001, should be the same for both ports. The recommended and most clear way to get same input-bias setting for both ports is to assign same input-bias for the ports (Port13 and Port14). If different input-bias-values are assigned to the ports then resulting input-bias for the encoder-ports will be like this table shows:

Port13 Input-Bias OD_0x2001_0D	Port14 Input-Bias OD_0x2001_0E	Encoder Input-Bias
NB	NB	NB = 0 = No bias
NB	PD	PD = 2 = Pull-Down
PD	NB	PD = 2 = Pull-Down
PD	PD	PD = 2 = Pull-Down
NB	PU	PU = 1 = Pull-Up
PU	NB	PU = 1 = Pull-Up
PD	PU	PU = 1 = Pull-Up
PU	PD	PU = 1 = Pull-Up
PU	PU	PU = 1 = Pull-Up



2.2. Storing of configuration parameters

Configuration parameters can be stored through writing to OD index 0x1010. Restore of default parameters can be done by writing to OD index 0x1011. Some parameters like node-id and baud rate are excluded from the store/restore functions.

The storing of configuration parameters to non-volatile memory is a relative slow operation. It is recommended to not switch of power during storage of parameters.

2.3. Error behaviour

If a serious CANopen device failure is detected in NMT state Operational, the CrossFire™ IX will autonomously enter the NMT state Pre-operational. This makes the outputs to be switched off.

The following errors will make the node go to pre-operational:

- CAN Communication error
    - Bus-off conditions of the CAN interface
    - Life guarding event with the state ‘occurred’ and the reason 'time out'
    - Heartbeat event with state ‘occurred’ and the reason 'time out"

2.4. Status LED indicator

LED indicator conforms to CiA 303-3 standard

Run LED – Green

CANopen mode	State	Blinking Pattern
Operational	LED ON	Constantly ON
Pre-Operational Initializing	LED Blinking	Iso-phase on and off with a frequency of approximately 2,5 Hz: (ON 200ms, OFF 200ms)
Stopped	LED Single Flash	One short flash: (ON 200ms, OFF 1000ms)

Error LED – Red

CANopen mode	State	Blinking Pattern
CAN Bus-Off	LED ON	Constantly ON
CAN Bus Warning	LED Single Flash	One short flash: (ON 200ms, OFF 1000ms)
Output Port Error	LED Blinking	Iso-phase on and off with a frequency of approximately 2,5 Hz: (ON 200ms, OFF 200ms) The red error blinking is only shown during interleaving 2,5 seconds intervals.

2.5. Status LED indicator in boot mode

Boot mode is activated when firmware upgrade is started, it might also be activated if a failed firmware upgrade has been performed. The boot-mode-LED indicators should only show when firmware upgrades are performed or if the firmware state is not OK.

Green LED – IX Boot mode LED

IX Boot mode	Blinking Pattern	Description
IDLE	LED Slow-Blinking	In boot mode and no upgrade in progress This state is usually an indication that a manual restart is needed after a firmware upgrade.
SW-UPGRADE	LED Fast-Tipple-Blinking	Firmware upgrade in progress

Red LED – IX Boot Firmware error LED

IX Boot error	LED State	Description
NO-ERROR	LED-OFF	NO Firmware error
ERROR	LED-ON	Firmware error is present. Must be repaired with new firmware upgrade.
LOW SUPPLY VCC	LED-FLASHING	Low supply voltage. Supply voltage must exceed ~7.2 V otherwise SW start is blocked with the RED-LED-FLASHING

2.6. EMCY object overview

Emergency objects are triggered by the occurrence of a CANopen device internal error situation and are transmitted from an emergency producer on the CANopen device.
The following error codes are supported:

#	Error Code	Error Register	Manufacturer specific error field	Description
0	0x0000	0x00		EMCYERRC_NO_ERROR
1	0x8110	0x11		EMCYERRC_CAN_OVERRUN
2	0x8120	0x11		EMCYERRC_CAN_IN_ERROR_PASSIVE_MODE
3	0x8130	0x11		EMCYERRC_LIFEGUARD_ERROR_OR_HEARTBEAT_ERROR
4	0x8140	0x11		EMCYERRC_RECOVERED_FROM_BUSOFF
5	0x8210	0x01		EMCYERRC_PDO_NOT_PROCESSED_DUE_TO_LENGTH_ERROR

2.7. Receive PDOs

This section describes the Receive PDO information to the CrossFire™ IX. The information received on these PDOs will directly affect the CrossFire™ IX outputs.

Output ports 1-4 are configurable as either digital (Digital output) or analog (PWM).

Output ports 5-8 are configurable as either digital (Digital output) or analog (PWM, PWMi).

By default, all ports are configured to "Not Used". To reconfigure the ports, index 0x2002 is used. For further information, see the description of the Object Dictionary.

By default, the PDOs of the node are mapped to the I/O following the mapping described in CiA401.

Receive PDO 1, RPDO1: COB ID: 200h + Node ID, DEFAULT LENGTH: 1 byte

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0..7 Ports 1 to 8 **Digital ON/OFF** [2] 0x6200-01	Bytes not included in default PDO configuration						

PDO-Mapping, PDO-Parameters

Receive PDO 2, RPDO2: COB ID: 300h + Node ID, DEFAULT LENGTH: 8 bytes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 **Analog Output** [3] 0x6411-01		Port 2 **Analog Output** [3] 0x6411-02		Port 3 **Analog Output** [3] 0x6411-03		Port 4 **Analog Output** [3] 0x6411-04	

PDO-Mapping, PDO-Parameters

Receive PDO 3, RPDO3: COB ID: 400h + Node ID, DEFAULT LENGTH: 8 bytes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 5 **Analog Output** [3] 0x6411-05		Port 6 **Analog Output** [3] 0x6411-06		Port 7 **Analog Output** [3] 0x6411-07		Port 8 **Analog Output** [3] 0x6411-08	

PDO-Mapping, PDO-Parameters

Receive PDO 4, RPDO4: COB ID: 500h + Node ID, DEFAULT LENGTH: 2 bytes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Output 1 … 8 **retry after fault flag** 0x2012-00		Bytes not included in default PDO configuration					

PDO-Mapping, PDO-Parameters

[2] Only bits that correspond to port configured as Digital Output will be used.
[3] Only values that correspond to port configured as PWM or PWMi will be used.

2.8. Transmit PDOs

This section describes the Transmit PDO information from the CrossFire™ IX. The information transmitted on these Transmit PDOs directly reflects the status of the CrossFire™ IX inputs.

There are 8 input ports (input 1-8) that all are configurable as either digital (Digital input) or analog inputs (Voltage 0-10V, Voltage 0-32V, Current 4-20mA).

There are 4 inputs (input 9-12) that only support digital input mode.

There are 2 inputs (input 13, 14) that support digital, frequency or encoder mode.

By default, all ports are configured to "Not used". To reconfigure the ports, index 0x2000 is used. For further information, see description of Object Dictionary.

The default transmission type for the Transmit PDOs is 255 (Event Triggered). This means that the Transmit PDOs will be sent only when a change occurs. Note, when reading analog inputs event triggered an inhibit time should be configured to prevent a heavy bus load due to intense changes from background noise. By default an inhibit time of 100 ms is used except for PDO1.

By default, the PDOs of the node are mapped to the I/O following the mapping described in CiA401:

Transmit PDO 1, TPDO1: COB ID: 180h + Node ID, DEFAULT LENGTH: 2 bytes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0..7 Ports 1 – 8* **Digital Input** 0x6000-01	0..7 Ports 9 – 14* **Digital Input** 0x6000-02	Bytes not included in default PDO configuration					

* Only bits that correspond to ports configured as Digital Inputs will be used.
PDO-Mapping, PDO-Parameters

Transmit PDO 2, TPDO2: COB ID: 280h + Node ID, DEFAULT LENGTH: 8 bytes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 **Analog Input *** 0x6401-01		Port 2 **Analog Input *** 0x6401-02		Port 3 **Analog Input *** 0x6401-03		Port 4 **Analog Input *** 0x6401-04	

* Value will only be valid if port is configured as an Analog Input.
PDO-Mapping, PDO-Parameters

Transmit PDO 3, TPDO3: COB ID: 380h + Node ID, DEFAULT LENGTH: 8 bytes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 5 **Analog Input *** 0x6401-05		Port 6 **Analog Input *** 0x6401-06		Port 7 **Analog Input *** 0x6401-07		Port 8 **Analog Input *** 0x6401-08	

* Value will only be valid if port is configured as an Analog Input.
PDO-Mapping, PDO-Parameters

Transmit PDO 4, TPDO4: COB ID: 480h + Node ID, DEFAULT LENGTH: 4 bytes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 13 **Analog Input *** 0x6401-0D		Port 14 **Analog Input *** 0x6401-0E		Bytes not included in default PDO configuration			

* Only support for frequency/encoder.
PDO-Mapping, PDO-Parameters

Transmit PDO5, TPDO5: Default not active, DEFAULT LENGTH: 8 bytes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 **Current Feedback** 0x2016-01		Port 2 **Current Feedback** 0x2016-02		Port 3 **Current Feedback** 0x2016-03		Port 4 **Current Feedback** 0x2016-04	

PDO-Mapping, PDO-Parameters

Transmit PDO6, TPDO6: Default not active, DEFAULT LENGTH: 8 bytes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 5 **Current Feedback** 0x2016-05		Port 6 **Current Feedback** 0x2016-06		Port 7 **Current Feedback** 0x2016-07		Port 8 **Current Feedback** 0x2016-08	

PDO-Mapping, PDO-Parameters

Transmit PDO7, TPDO7: Default not active, DEFAULT LENGTH: 8 bytes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 **Output status bits** 0x201B-01	Port 2 **Output status bits** 0x201B-02	Port 3 **Output status bits** 0x201B-03	Port 4 **Output status bits** 0x201B-04	Port 5 **Output status bits** 0x201B-05	Port 6 **Output status bits** 0x201B-06	Port 7 **Output status bits** 0x201B-07	Port 8 **Output status bits** 0x201B-08

PDO-Mapping, PDO-Parameters

3. Object Dictionary

3.1. Communication Profile Area, Part1, Index 0x1000 to 0x11FF

Index	S-Idx	Type	Default	Saved	Description
0x1000	0x00	u32, ro	0xF191	-	**Device type**: CiA401, analog in/out, digital in/out.
0x1001	0x00	u8, ro	0	-	**Error Register**: Bit coded as specified in CiA301.
0x1003	0x00	U8, ro	0	-	**Pre-Defined Error Field**: (Number of entries.)
	0x01	u32, ro	0	-	Latest error
	0x02	u32, ro	0	-	2nd last error
	0x03	u32, ro	0	-	3rd last error
	0x04	u32, ro	0	-	4th last error
	0x05	u32, ro	0	-	5th last error
0x1005	0x00	u32,rw	0x80	No	**COB-ID SYNC message**
0x1006	0x00	u32,rw	0	Yes	**Communication cycle period**. Resolution is 1 µs but the interval must be in multiples of 1ms (1000µs).
0x1008	0x00	string, ro	CrossFire IX	-	**Manufacturer device name**
0x100A	0x00	string, ro	-	-	**Manufacturer software version**
0x100C	0x00	u16, rw	0	Yes	**Guard time**: as specified in CiA301.
0x100D	0x00	u8, rw	0	Yes	**Life time factor**: as specified in CiA301.
0x1010	0x00	u8, ro	4	-	**Store parameters**: Highest sub-index supported
	0x01	u32, rw	1	No	Save all parameters by writing "save" in ASCII or 0x65766173.
	0x02	u32, rw	1	No	Save communication parameters by writing "save" in ASCII or 0x65766173.
	0x03	u32, rw	1	No	Save application parameters by writing "save" in ASCII or 0x65766173. (NOT USED IN CURRENT VERSION)
	0x04	u32, rw	1	No	Save manufacturer parameters by writing "save" in ASCII or 0x65766173.
0x1011	0x00	u8, ro	4	-	**Restore default parameters**: Highest sub-index supported
	0x01	u32, rw	1	No	Restore all default parameters by writing "load" in ASCII or 0x64616F6C. The entire object dictionary will get reset to default values.
	0x02	u32, rw	1	No	Restore communication default parameters by writing "load" in ASCII or 0x64616F6C. Communication parameters in object dictionary will get reset to default values. Note that a restart is needed to be able to see that parameters are reset and also until they take effect. Node id and baud rate is not reset.
	0x03	u32, rw	1	No	Restore application default parameters by writing "load" in ASCII or 0x64616F6C. Application default parameters in object dictionary will get reset to default values. (NOT USED IN CURRENT VERSION)
	0x04	u32, rw	1	No	Restore manufacturer default parameters by writing "load" in ASCII or 0x64616F6C. Application default parameters in object dictionary will get reset to default values.

0x1014	0x00	u32, ro	0x80 + NodeId	Yes	**EMCY COB ID**: as specified in CiA301.
0x1016	0x00	u8, ro	1	-	**Heartbeat**: Number of entries.
	0x01	u32, rw	0	Yes	Consumer Heartbeat Time: Monitoring time for node xx as specified in CiA301.
0x1017	0x00	u16, rw	0	Yes	**Producer heartbeat time**: as specified in CiA301
0x1018	0x00	u8, ro	3	-	**Identity Object**: Number of entries.
	0x01	u32, ro	0xF2	-	Vendor ID.
	0x02	u32, ro	0x8A	-	Product code.
	0x03	u32, ro	-	-	Revision number.

3.2. SDO server parameters, Index 0x1200 to 0x127F

Index	S-Idx	Type	Default	Saved	Description
0x1200	0x00	u8, ro	2	-	**SDO server parameter**: Number of entries.
	0x01	u32, ro	0x600 + NodeId	-	COB_ID Client->Server
	0x02	u32, ro	0x580 + NodeId	-	COB_ID Server->Client

3.3. RPDO communication parameters, Index 0x1400 to 0x15FF

Index	S-Idx	Type	Default	Saved	Description
0x1400	0x00	u8, ro	5	-	**RPDO1**: Highest sub-index supported.
	0x01	u32, rw	0x200 + NodeId	Yes	COB_ID for receive RPDO1.
	0x02 0x03 0x05	-	-	-	RX-N/A. Non-applicable parameters for receive. Do not use them for receive.
0x1401	0x00	u8, ro	5	-	**RPDO2**: Highest sub-index supported.
	0x01	u32, rw	0x300 + NodeId	Yes	COB_ID for receive RPDO2.
	0x02 0x03 0x05	-	-	-	RX-N/A. Non-applicable parameters for receive. Do not use them for receive.
0x1402	0x00	u8, ro	5	-	**RPDO3**: Highest sub-index supported.
	0x01	u32, rw	0x400 + NodeId	Yes	COB_ID for receive RPDO3.
	0x02 0x03 0x05	-	-	-	RX-N/A. Non-applicable parameters for receive. Do not use them for receive.
0x1403	0x00	u8, ro	5	-	**RPDO4**: Highest sub-index supported.
	0x01	u32, rw	0x500 + NodeId	Yes	COB_ID for receive RPDO4.
	0x02 0x03 0x05	-	-	-	RX-N/A. Non-applicable parameters for receive. Do not use them for receive.

Note that to be able to use custom settings for the PDO COB_ID's the flag No_PDO_NodeId_Override_0x2032 must be set otherwise the default NodeId dependent COB_ID's will be used.

3.4. RPDO mapping parameters, Index 0x1600 to 0x17FF

Index	S-Idx	Type	Default	Saved	Description
0x1600	0x00	u8, rw	1	Yes	**RPDO1**: Number of mapped application objects in PDO.
	0x01	u32, rw	0x62000108	Yes	1st (only) mapped object for receive RPDO1.
	0x02-0x08	u32, rw	-	Yes	*Can be used when RPDO1 is changed to other mapping*
	Byte 1: 0..7 Ports 1 to 8 **Digital ON/OFF** [2, 3] 0x6200-01	Byte 2 Byte 3 Byte 4 Byte 5 Byte 6 Byte 7 Byte 8: Bytes not included in default PDO configuration			
0x1601	0x00	u8, rw	4	Yes	**RPDO2**: Number of mapped application objects in PDO.
	0x01	u32, rw	0x64110110	Yes	1st mapped object for RPDO2.
	0x02	u32, rw	0x64110210	Yes	2nd mapped object for RPDO2.
	0x03	u32, rw	0x64110310	Yes	3rd mapped object for RPDO2.
	0x04	u32, rw	0x64110410	Yes	4th mapped object for RPDO2.
	0x05-0x08	u32, rw	-	Yes	*Can be used when RPDO2 is changed to other mapping*
	Byte 1 Byte 2: Port 1 **Analog Output** [4] 0x6411-01	Byte 3 Byte 4: Port 2 **Analog Output** [4] 0x6411-02	Byte 5 Byte 6: Port 3 **Analog Output** [4] 0x6411-03	Byte 7 Byte 8: Port 4 **Analog Output** [4] 0x6411-04	
0x1602	0x00	u8, rw	4	Yes	**RPDO3**: Number of mapped application objects in PDO.
	0x01	u32, rw	0x64110510	Yes	1st mapped object for RPDO3.
	0x02	u32, rw	0x64110610	Yes	2nd mapped object for RPDO3.
	0x03	u32, rw	0x64110710	Yes	3rd mapped object for RPDO3.
	0x04	u32, rw	0x64110810	Yes	4th mapped object for RPDO3.
	0x05-0x08	u32, rw	-	Yes	*Can be used when RPDO3 is changed to other mapping*
	Byte 1 Byte 2: Port 5 **Analog Output** [4] 0x6411-05	Byte 3 Byte 4: Port 6 **Analog Output** [4] 0x6411-06	Byte 5 Byte 6: Port 7 **Analog Output** [4] 0x6411-07	Byte 7 Byte 8: Port 8 **Analog Output** [4] 0x6411-08	
0x1603	0x00	u8, rw	1	Yes	**RPDO4**: Number of mapped application objects in PDO.
	0x01	u32, rw	0x20120010	Yes	1st (only) mapped object for RPDO4.
	0x02-0x08	u32, rw	-	Yes	*Can be used when RPDO4 is changed to other mapping*
	Byte 1 Byte 2: **Output 1 ... 8 retry after fault flag** 0x2012-00	Byte 3 Byte 4 Byte 5 Byte 6 Byte 7 Byte 8: Bytes not included in default PDO configuration			

3.5. TPDO communication parameters, Index 0x1800 to 0x19FF

Index	S-Idx	Type	Default	Saved	Description
0x1800	0x00	u8, ro	5	-	**TPDO1**: Highest sub-index supported.
	0x01	u32, rw	0x180 + NodeId	Yes	COB_ID for transmit TPDO1.
	0x02	u8, rw	255	Yes	Transmission type for TPDO1.
	0x03	u16, rw	0	Yes	Inhibit time for TPDO1.
	0x05	u16, rw	0	Yes	Event timer for TPDO1.
0x1801	0x00	u8, ro	5	-	**TPDO2**: Highest sub-index supported.
	0x01	u32, rw	0x280 + NodeId	Yes	COB_ID for transmit TPDO2.
	0x02	u8, rw	255	Yes	Transmission type for TPDO2.
	0x03	u16, rw	100	Yes	Inhibit time for TPDO2.
	0x05	u16, rw	0	Yes	Event timer for TPDO2.
0x1802	0x00	u8, ro	5	-	**TPDO3**: Highest sub-index supported.
	0x01	u32, rw	0x380 + NodeId	Yes	COB_ID for transmit TPDO3.
	0x02	u8, rw	255	Yes	Transmission type for TPDO3.
	0x03	u16, rw	100	Yes	Inhibit time for TPDO3.
	0x05	u16, rw	0	Yes	Event timer for TPDO3.
0x1803	0x00	u8, ro	5	-	**TPDO4**: Highest sub-index supported.
	0x01	u32, rw	0x480 + NodeId	Yes	COB_ID for transmit TPDO4.
	0x02	u8, rw	255	Yes	Transmission type for TPDO4.
	0x03	u16, rw	100	Yes	Inhibit time for TPDO4.
	0x05	u16, rw	0	Yes	Event timer for TPDO4.
0x1804	0x00	u8, ro	5	-	**TPDO5**: Highest sub-index supported.
	0x01	u32, rw	0x80000000	Yes	COB_ID for transmit TPDO5. (Default disabled).
	0x02	u8, rw	255	Yes	Transmission type for TPDO5.
	0x03	u16, rw	100	Yes	Inhibit time for TPDO5.
	0x05	u16, rw	0	Yes	Event timer for TPDO5.
0x1805	0x00	u8, ro	5	-	**TPDO6**: Highest sub-index supported.
	0x01	u32, rw	0x80000000	Yes	COB_ID for transmit TPDO6. (Default disabled).
	0x02	u8, rw	255	Yes	Transmission type for TPDO6.
	0x03	u16, rw	100	Yes	Inhibit time for TPDO6.
	0x05	u16, rw	0	Yes	Event timer for TPDO6.
0x1806	0x00	u8, ro	5	-	**TPDO7**: Highest sub-index supported.
	0x01	u32, rw	0x80000000	Yes	COB_ID for transmit TPDO7 (Default disabled).

0x02	u8, rw	255	Yes	Transmission type for TPDO 7.
0x03	u16, rw	100	Yes	Inhibit time for TPDO7.
0x05	u16, rw	0	Yes	Event timer for TPDO7.

Note that to be able to use custom settings for the PDO COB_ID's the flag No_PDO_NodeId_Override_0x2032 must be set otherwise the default NodeId dependent COB_ID's will be used.

3.6. TPDO mapping parameters, Index 0x1A00 to 0x1BFF

Index	S-Idx	Type	Default	Saved	Description
0x1A00	0x00	u8, rw	2	Yes	TPDO1: Number of mapped application objects in PDO.
	0x01	u32, rw	0x60000108	Yes	1st mapped object for TPDO1.
	0x02	u32, rw	0x60000208	Yes	2nd mapped object for TPDO1.
	0x03-0x08	u32, rw	-	Yes	*Can be used when TPDO1 is changed to other mapping.*
	Byte 1: 0..7 Ports 1 – 8* **Digital Input** 0x6000-01	Byte 2: 0..7 Ports 9 – 14* **Digital Input** 0x6000-02	Byte 3 Byte 4 Byte 5 Byte 6 Byte 7 Byte 8: Bytes not included in default PDO configuration		
0x1A01	0x00	u8, rw	4	Yes	TPDO2: Number of mapped application objects in PDO.
	0x01	u32, rw	0x64010110	Yes	1st mapped object for TPDO2.
	0x02	u32, rw	0x64010210	Yes	2nd mapped object for TPDO2.
	0x03	u32, rw	0x64010310	Yes	3rd mapped object for TPDO2.
	0x04	u32, rw	0x64010410	Yes	4th mapped object for TPDO2.
	0x05-0x08	u32, rw	-	Yes	*Can be used when TPDO2 is changed to other mapping.*
	Byte 1 Byte 2: Port 1 **Analog Input** * 0x6401-01	Byte 3 Byte 4: Port 2 **Analog Input** * 0x6401-02	Byte 5 Byte 6: Port 3 **Analog Input** * 0x6401-03	Byte 7 Byte 8: Port 4 **Analog Input** * 0x6401-04	
0x1A02	0x00	u8, rw	4	Yes	TPDO3: Number of mapped application objects in PDO.
	0x01	u32, rw	0x64010510	Yes	1st mapped object for TPDO3.
	0x02	u32, rw	0x64010610	Yes	2nd mapped object for TPDO3.
	0x03	u32, rw	0x64010710	Yes	3rd mapped object for TPDO3.
	0x04	u32, rw	0x64010810	Yes	4th mapped object for TPDO3.
	0x05-0x08	u32, rw	-	Yes	*Can be used when TPDO3 is changed to other mapping.*
	Byte 1 Byte 2: Port 5 **Analog Input** * 0x6401-05	Byte 3 Byte 4: Port 6 **Analog Input** * 0x6401-06	Byte 5 Byte 6: Port 7 **Analog Input** * 0x6401-07	Byte 7 Byte 8: Port 8 **Analog Input** * 0x6401-08	
0x1A03	0x00	u8, rw	4	Yes	TPDO4: Number of mapped application objects in PDO.
	0x01	u32, rw	0x64010D10	Yes	1st mapped object for TPDO4.
	0x02	u32, rw	0x64010E10	Yes	2nd mapped object for TPDO4.
	0x03-0x08	u32, rw	-	Yes	*Can be used when TPDO4 is changed to other mapping.*
	Byte 1 Byte 2: Port 13 **Analog Input** * 0x6401-0D	Byte 3 Byte 4: Port 14 **Analog Input** * 0x6401-0E	Byte 5 Byte 6 Byte 7 Byte 8: Bytes not included in default PDO configuration		
0x1A04	0x00	u8, rw	4	Yes	TPDO5: Number of mapped application objects in PDO.
	0x01	u32, rw	0x20160110	Yes	1st mapped object for TPDO5.

	0x02	u32, rw	0x20160210	Yes	2nd mapped object for TPDO5.
	0x03	u32, rw	0x20160310	Yes	3rd mapped object for TPDO5.
	0x04	u32, rw	0x20160410	Yes	4th mapped object for TPDO5.
	0x05-0x08	u32, rw	-	Yes	*Can be used when TPDO5 is changed to other mapping.*

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 **Current Feedback** 0x2016-01		Port 2 **Current Feedback** 0x2016-02		Port 3 **Current Feedback** 0x2016-03		Port 4 **Current Feedback** 0x2016-04	

0x1A05	0x00	u8, rw	4	Yes	**TPDO6**: Number of mapped application objects in PDO.
	0x01	u32, rw	0x20160510	Yes	1st mapped object for TPDO6.
	0x02	u32, rw	0x20160610	Yes	2nd mapped object for TPDO6.
	0x03	u32, rw	0x20160710	Yes	3rd mapped object for TPDO6.
	0x04	u32, rw	0x20160810	Yes	4th mapped object for TPDO6.
	0x05-0x08	u32, rw	-	Yes	*Can be used when TPDO6 is changed to other mapping.*

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 5 **Current Feedback** 0x2016-05		Port 6 **Current Feedback** 0x2016-06		Port 7 **Current Feedback** 0x2016-07		Port 8 **Current Feedback** 0x2016-08	

0x1A06	0x00	u8, rw	8	Yes	**TPDO7**: Number of mapped application objects in PDO.
	0x01	u32, rw	0x201B0108	Yes	1st mapped object for TPDO7.
	0x02	u32, rw	0x201B0208	Yes	2nd mapped object for TPDO7.
	0x03	u32, rw	0x201B0308	Yes	3rd mapped object for TPDO7.
	0x04	u32, rw	0x201B0408	Yes	4th mapped object for TPDO7.
	0x05	u32, rw	0x201B0508	Yes	5th mapped object for TPDO7.
	0x06	u32, rw	0x201B0608	Yes	6th mapped object for TPDO7.
	0x07	u32, rw	0x201B0708	Yes	7th mapped object for TPDO7.
	0x08	u32, rw	0x201B0808	Yes	8th mapped object for TPDO7.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Port 1 [5] **Output status bits** 0x201B-01	Port 2 [5] **Output status bits** 0x201B-02	Port 3 [5] **Output status bits** 0x201B-03	Port 4 [5] **Output status bits** 0x201B-04	Port 5 [5] **Output status bits** 0x201B-05	Port 6 [5] **Output status bits** 0x201B-06	Port 7 [5] **Output status bits** 0x201B-07	Port 8 [5] **Output status bits** 0x201B-08

3.7. Communication Profile Area, Part2, Index 0x1C00 to 0x1FFF

Index	S-Idx	Type	Default	Saved	Description
0x1F51	0x00	u8,ro	1	-	**Program control**: Number programs on the node
	0x01	u8,rw	1	No	Program number 1. Write 0 to go to boot.

3.8. Manufacturer Specific Profile Area1, Index 0x2000 to 0x2FFF

Index	S-Idx	Type	Default (possible)	Saved	Description
0x2000	0x00	u8, ro	14	-	**Input Port Configuration** The values used have the following meaning for sub-indices 1 to 14: 0 = Port Not Used 1 = Reserved 2 = Voltage 0-10V 3 = Voltage 0-32V 4 = Current Input (4-20mA) 5 = Digital Input 6 = Encoder Input 7 = Frequency Measurement (1-20000Hz)
	0x01	u8, rw	0 (0,2,3,4,5)	Yes	Port configuration for port 1
	0x02	u8, rw	0 (0,2,3,4,5)	Yes	Port configuration for port 2
	0x03	u8, rw	0 (0,2,3,4,5)	Yes	Port configuration for port 3
	0x04	u8, rw	0 (0,2,3,4,5)	Yes	Port configuration for port 4
	0x05	u8, rw	0 (0,2,3,4,5)	Yes	Port configuration for port 5
	0x06	u8, rw	0 (0,2,3,4,5)	Yes	Port configuration for port 6
	0x07	u8, rw	0 (0,2,3,4,5)	Yes	Port configuration for port 7
	0x08	u8, rw	0 (0,2,3,4,5)	Yes	Port configuration for port 8
	0x09	u8, rw	0 (0,5)	Yes	Port configuration for port 9
	0x0A	u8, rw	0 (0,5)	Yes	Port configuration for port 10
	0x0B	u8, rw	0 (0,5)	Yes	Port configuration for port 11
	0x0C	u8, rw	0 (0,5)	Yes	Port configuration for port 12
	0x0D	u8, rw	0 (0,5,6,7)	Yes	Port configuration for port 13
	0x0E	u8, rw	0 (0,5,6,7)	Yes	Port configuration for port 14
0x2001	0x00	u8, ro	14	-	**Input Port Bias** The values used have the following meaning for sub-indices 1 to 14: 0 = No bias

					1 = Pull-Up 2 = Pull-Down
	0x01	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 1
	0x02	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 2
	0x03	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 3
	0x04	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 4
	0x05	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 5
	0x06	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 6
	0x07	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 7
	0x08	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 8
	0x09	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 9
	0x0A	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 10
	0x0B	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 11
	0x0C	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 12
	0x0D	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 13 Check chapter 2.1.4 for Encoder-input
	0x0E	u8, rw	0 (0,1,2)	Yes	Bias configuration for port 14 Check chapter 2.1.4 for Encoder-input
0x2002	0x00	u8, ro	8	-	**Output Port Configuration**: Number of entries. The values used have the following meaning for sub-indices 1 to 8: 0 = Port Not Used 1 = PWM 2 = PWMi 3 = Digital Port 1 to 4 does not support PWMi (mode 2).
	0x01	u8, rw	0 (0,1,3)	Yes	Port configuration for port 1
	0x02	u8, rw	0 (0,1,3)	Yes	Port configuration for port 2
	0x03	u8, rw	0 (0,1,3)	Yes	Port configuration for port 3
	0x04	u8, rw	0 (0,1,3)	Yes	Port configuration for port 4
	0x05	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 5
	0x06	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 6
	0x07	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 7
	0x08	u8, rw	0 (0,1,2,3)	Yes	Port configuration for port 8
0x2003	0x00	u8, ro	8	-	**Output Port PWM Frequency**, Number of entries. The values used have the following meaning for sub-indices 1 to 8: Value is in Hz. Valid values 50-400Hz NOTE! For PWMi a fixed high frequency is used - PWM

					frequency setting has no effect.
	0x01	u16, rw	100 (50-400)	Yes	PWM Frequency for port 1
	0x02	u16, rw	100 (50-400)	Yes	PWM Frequency for port 2
	0x03	u16, rw	100 (50-400)	Yes	PWM Frequency for port 3
	0x04	u16, rw	100 (50-400)	Yes	PWM Frequency for port 4
	0x05	u16, rw	100 (50-400)	Yes	PWM Frequency for port 5
	0x06	u16, rw	100 (50-400)	Yes	PWM Frequency for port 6
	0x07	u16, rw	100 (50-400)	Yes	PWM Frequency for port 7
	0x08	u16, rw	100 (50-400)	Yes	PWM Frequency for port 8
0x2004	0x00	u8, ro	8	-	**Output Port Dither Frequency**: Number of entries. The values used have the following meaning for sub-indices 5 to 8: Value is in Hz. Valid values 25-400Hz. NOTE! Not all values between 25-400Hz are supported. If an unsupported value is written, the closest possible value is selected automatically.
	0x01	u16, rw	100 (25-400)	Yes	Dither Frequency for port 1 - Not applicable
	0x02	u16, rw	100 (25-400)	Yes	Dither Frequency for port 2 - Not applicable
	0x03	u16, rw	100 (25-400)	Yes	Dither Frequency for port 3 - Not applicable
	0x04	u16, rw	100 (25-400)	Yes	Dither Frequency for port 4 - Not applicable
	0x05	u16, rw	100 (25-400)	Yes	Dither Frequency for port 5
	0x06	u16, rw	100 (25-400)	Yes	Dither Frequency for port 6
	0x07	u16, rw	100 (25-400)	Yes	Dither Frequency for port 7
	0x08	u16, rw	100 (25-400)	Yes	Dither Frequency for port 8
0x2005	0x00	u8, ro	8	-	**Output Port Dither Amplitude**: Number of entries. The values used have the following meaning for sub-indices 5 to 8: Valid values 0-400 which corresponds to 0-400mA Note that when using a high dither frequency, the dither will be attenuated by the inductance of the valve.
	0x01	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 1 - Not applicable
	0x02	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 2 - Not applicable
	0x03	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 3 - Not applicable
	0x04	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 4 - Not applicable
	0x05	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 5
	0x06	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 6
	0x07	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 7
	0x08	u16, rw	100 (0-400)	Yes	Dither Amplitude for port 8
0x2006	0x00	u8, ro	8	-	**Output Port Current Regulator Proportional Value "P"**: Number of entries. The values used have the following meaning for sub-

					indices 5 to 8: Valid values 0 - 5000 NOTE! An increased P valued gives an increased proportional gain
	0x01	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 1 - Not applicable
	0x02	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port - Not applicable
	0x03	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 3 - Not applicable
	0x04	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 4 - Not applicable
	0x05	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 5
	0x06	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 6
	0x07	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 7
	0x08	u16, rw	1000 (0-5000)	Yes	Current Regulator Proportional Value "P" for port 8
0x2007	0x00	u8, ro	8	-	**Output Port Current Regulator Integral Value "I"**: Number of entries. The values used have the following meaning for sub-indices 5 to 8: Valid values 0-100 NOTE! An increased I value means increased integrator effect
	0x01	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 1 - Not applicable
	0x02	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 2 - Not applicable
	0x03	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 3 - Not applicable
	0x04	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 4 - Not applicable
	0x05	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 5
	0x06	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 6
	0x07	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 7
	0x08	u8, rw	25 (0-100)	Yes	Current Regulator Integral Value "I" for port 8
0x2008	0x00	u8, ro	8	-	**Output Port Current Regulator Derivative Value "D"**: Number of entries. Not implemented, do not use! Valid values 0
	0x01	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 1 - Not applicable
	0x02	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 2 - Not applicable
	0x03	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 3 - Not applicable
	0x04	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 4 - Not applicable
	0x05	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 5
	0x06	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 6
	0x07	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 7
	0x08	u16, rw	0	Yes	Current Regulator Derivative Value "D" for port 8

0x2009	0x00	u8, ro	8	-	**Digital Output Port Soft-start parameter A** Number of entries. Soft start can be activated on output 5-8 in digital mode to be able to drive capacitive load. Soft start is per default off. Decides the A parameter used in the soft-start ramp according to formula below: $y = \frac{A}{1024} \cdot e^{\frac{B}{255}x}$ Valid values 0-255. Set to 0 to deactivate soft start. A lower value gives a slower start.
	0x01	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter A for port 1 – Not applicable
	0x02	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter A for port 2 - Not applicable
	0x03	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter A for port 3 - Not applicable
	0x04	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter A for port 4 - Not applicable
	0x05	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter A for port 5
	0x06	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter A for port 6
	0x07	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter A for port 7
	0x08	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter A for port 8
0x200A	0x00	u8, ro	8	-	**Digital Output Port Soft-start parameter B** Number of entries. Soft start can be activated on output 5-8 in digital mode to be able to drive capacitive load. Soft start is per default off. Decides the B parameter used in the soft-start ramp according to formula below: $y = \frac{A}{1024} \cdot e^{\frac{B}{255}x}$ Valid values 0-255.
	0x01	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 1 - Not applicable
	0x02	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 2 - Not applicable
	0x03	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 3 - Not applicable
	0x04	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 4 - Not applicable
	0x05	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 5
	0x06	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 6
	0x07	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 7
	0x08	u8, rw	0 (0-255)	Yes	Output Port Soft-start parameter B for port 8
0x2010	0x00	u8, rw	1 (0-127)	Yes	**CANopen Node ID** When node ID is assigned to 0 Node ID is read from ID pins (Full description, see section: ID Interface) Valid values are 0 – 127. (Valid after reboot). This value is not affected by store/restore (0x1010/0x1011).
0x2011	0x00	u8, rw	3 (0-8)	Yes	**CAN baudrate** Possible values are:

					0 = 1000 kbit/s 1 = 800 kbit/s 2 = 500 kbit/s 3 = 250 kbit/s 4 = 125 kbit/s 5 = 100 kbit/s 6 = 50 kbit/s 7 = 20 kbit/s 8 = 10 kbit/s (Valid after reboot) This value is not affected by store/restore (0x1010/0x1011).
0x2012	0x00	u16, rw	0 (0-255)	No	**Retry after fault** for Outputs 1…8, RPDO4 Each output is deactivated after a detected fault. By writing a 1 to the corresponding bit in this object, the output is re-activated. When writing to this index only one retry attempt will be made (to all ports which have a 1 in the bit mask). To make a new retry, 0 must be written and then a new retry attempt can be made.
0x2015	0x00	08, ro	0	No	**CAN ID pin status**: see Node Id Interface
0x2016	0x00	08, ro	8	-	**Current Feedback**, TPDO5, TPDO6 Current feedback is available in all output modes. Values are in mA.
	0x01	u16, ro	0	No	Current Feedback port 1, TPDO5
	0x02	u16, ro	0	No	Current Feedback port 2, TPDO5
	0x03	u16, ro	0	No	Current Feedback port 3, TPDO5
	0x04	u16, ro	0	No	Current Feedback port 4, TPDO5
	0x05	u16, ro	0	No	Current Feedback port 5, TPDO6
	0x06	u16, ro	0	No	Current Feedback port 6, TPDO6
	0x07	u16, ro	0	No	Current Feedback port 7, TPDO6
	0x08	u16, ro	0	No	Current Feedback port 8, TPDO6
0x2017	0x00	U16, ro	0	No	**Input Status Bits** A bitmask with one bit for each input port. Only bit 1-14 are used. 0 = input ok 1 = input is shut off due to over current Inputs will be automatically switched on again after an over current shut off
0x201A	0x00	u8, ro	4	No	**Internal voltages** Values are in mV.
	0x01	u16, ro	0	No	Internal 3.3V
	0x02	u16, ro	0	No	Internal 5V
	0x03	u16, ro	0	No	External Supply voltage
	0x04	u16, ro	0	No	Sensor Supply (12V)
0x201B	0x00	u8, ro	8	-	**Output Status Bits**, TPDO7 For output 1-4: bit 1: Generic port error bit 2: Reserved

					bit 3: Reserved bit 4: Reserved bit 5: Reserved bit 6: Reserved bit 7: Reserved bit 8: Reserved For output 5-8: bit 1: Short to GND bit 2: Reserved bit 3: Reserved bit 4: Thermal warning bit 5: Charge pump under-voltage lockout (UVLO) bit 6: Over current bit 7: Reserved bit 8: Reserved The status for each output can be cleared by using Object 0x2012
	0x01	u8, ro	0	No	Output Status Port 1, TPDO7
	0x02	u8, ro	0	No	Output Status Port 2, TPDO7
	0x03	u8, ro	0	No	Output Status Port 3, TPDO7
	0x04	u8, ro	0	No	Output Status Port 4, TPDO7
	0x05	u8, ro	0	No	Output Status Port 5, TPDO7
	0x06	u8, ro	0	No	Output Status Port 6, TPDO7
	0x07	u8, ro	0	No	Output Status Port 7, TPDO7
	0x08	u8, ro	0	No	Output Status Port 8, TPDO7
0x201D	0x00	u8, ro	1	-	**Internal temperatures.**
	0x01	i16,ro	0	No	Board Temperature Temperature in degrees Celsius.
0x2027	0	U16, rw	0	No	**Restart** Writing the value 0x1234 causes a reset and the node application-SW will restart and perform a normal application startup and stay in PREOPERATIONAL until master changes that.
0x2028	0x00	U8, rw	0	No	**Reset encoder** Write 1 to this entry to reset encoder to 0.
0x2030	0x00	u8, ro	1	-	**Software Versions**
	0x01	u32, ro	-	No	Boot loader version
	0x02	u32, ro	-	No	Application version
0x2031	0x00	u8,rw	15 (0-15)	Yes	**Node id pins mask** This mask tells which digital in pins that will affect the node id when using node-id pins mode. Bit0 = 1 means that digital in 1 will be used in node-id calculation Bit1 = 1 means that digital in 2 will be used in node-id calculation Bit2 = 1 means that digital in 3 will be used in node-id calculation Bit3 = 1 means that digital in 4 will be used in node-id calculation

					Pins active will be set to pull up automatically This value is not affected by store/restore (0x1010/0x1011).
0x2032	0x00	u8, rw	0	Yes	**No PDO Node id override** To be able to use settings for the COB_ID of the PDOs, RPDO-parameters, TPDO-parameters this flag must be set to one (=1). Note that to be able to use custom settings for the PDO COB_ID's the flag No_PDO_NodeId_Override_0x2032 must be set otherwise the default NodeId dependent COB_ID's will be used. This value is not affected by store/restore (0x1010/0x1011).
0x2033	0x00	u8, ro	14	No	**Min frequency for frequency inputs** Sets the min frequency (in Hz) that can be measured with the frequency inputs. Setting a higher min frequency makes it possible for the CrossFire IX to set frequency to 0 faster if there is no signal.
	0x01	u16, rw	1 (0-65535)	No	Port1 min frequency - Not applicable
	0x02	u16, rw	1 (0-65535)	No	Port2 min frequency - Not applicable
	0x03	u16, rw	1 (0-65535)	No	Port3 min frequency - Not applicable
	0x04	u16, rw	1 (0-65535)	No	Port4 min frequency - Not applicable
	0x05	u16, rw	1 (0-65535)	No	Port5 min frequency - Not applicable
	0x06	u16, rw	1 (0-65535)	No	Port6 min frequency - Not applicable
	0x07	u16, rw	1 (0-65535)	No	Port7 min frequency - Not applicable
	0x08	u16, rw	1 (0-65535)	No	Port8 min frequency - Not applicable
	0x09	u16, rw	1 (0-65535)	No	Port9 min frequency - Not applicable
	0x0A	u16, rw	1 (0-65535)	No	Port10 min frequency - Not applicable
	0x0B	u16, rw	1 (0-65535)	No	Port11 min frequency - Not applicable
	0x0C	u16, rw	1 (0-65535)	No	Port12 min frequency - Not applicable
	0x0D	u16, rw	1 (0-65535)	Yes	Port13 min frequency - Frequency input 1
	0x0E	u16, rw	1 (0-65535)	Yes	Port14 min frequency - Frequency input 2
0x2036	0x00	u8, ro	8	No	**Analog input port filter length** Sets number of samples that are used for the average filter that are applied to form the Analog input value from the A/D-conversion samples. When assigned to ZERO the forgetting filter of 0x2037 are used instead. If 5 (default) is used and the sampling frequency is 50 Hz then filter length in time is 5*(1000/50) ms = 100 ms = 0.1 seconds. If 50 is used and the sampling frequency is 250 Hz then filter length in time is 50*(1000/250) ms = 200 ms = 0.2 seconds. If 50 is used and the sampling frequency is 50 Hz then

					filter length in time is 50*(1000/50) ms = 1000 ms = 1.0 seconds.
	0x01	u8, rw	5 (0-50)	Yes	Port1 filter length
	0x02	u8, rw	5 (0-50)	Yes	Port2 filter length
	0x03	u8, rw	5 (0-50)	Yes	Port3 filter length
	0x04	u8, rw	5 (0-50)	Yes	Port4 filter length
	0x05	u8, rw	5 (0-50)	Yes	Port5 filter length
	0x06	u8, rw	5 (0-50)	Yes	Port6 filter length
	0x07	u8, rw	5 (0-50)	Yes	Port7 filter length
	0x08	u8, rw	5 (0-50)	Yes	Port8 filter length
0x2037	0x00	u8, ro	8	No	**Analog input port weight forgetting filter** Weight factor for the classic forgetting filter: $y_k = (1 - \lambda) \cdot y_{k-1} + \lambda \cdot v_k$ v_k: Sampled A/D-value y_k: Filtered A/D-value λ: Weight forgetting filter in the range 0-100 % The filter length of 0x2036 must be set to ZERO for the forgetting filter to become active.
	0x01	u8, rw	20 (1-100)	Yes	Port1 filter weight
	0x02	u8, rw	20 (1-100)	Yes	Port2 filter weight
	0x03	u8, rw	20 (1-100)	Yes	Port3 filter weight
	0x04	u8, rw	20 (1-100)	Yes	Port4 filter weight
	0x05	u8, rw	20 (1-100)	Yes	Port5 filter weight
	0x06	u8, rw	20 (1-100)	Yes	Port6 filter weight
	0x07	u8, rw	20 (1-100)	Yes	Port7 filter weight
	0x08	u8, rw	20 (1-100)	Yes	Port8 filter weight
0x2038	0x00	u8, rw	50(50-250)	Yes	**Analog input port sampling frequency** Sampling frequency in Hz. This value is not affected by store/restore (0x1010/0x1011).
0x2039	0x00	u8, rw	1 (0,1)	Yes	**Ignition power save enabled** 0 = ignition signal is not used 1 = ignition signal is used This value is not affected by store/restore (0x1010/0x1011).

3.9. Manufacturer Specific Profile Area2, CrossControl Internal Specific Profile Area, Index 0x3000 to 0x5FFF

Internal Specific Profile Area for CrossControl specifics only to be used by CrossControl, typically production tests etc.

Index	S-Idx	Type	Default (possible)	Saved	Description
0x3004	0	u8, rw	0 (0-7)	No	**Supply shut-off** Bitmask bit 1: reserved bit 2: reserved bit 3: Shut off Sensor Supply => 0x4
0x3007	0x00	u16, rw	0	No	**Switch to CAN test mode** Not intended for customer use! Writing the value 0x1536 (magic number) to this parameter switches to CAN test mode. Test mode is used during production testing of the device. Power off the device to exit test can mode.

3.10. Device specific entries (CiA401), Index 0x6000 to 0x9FFF

Index	S-Idx	Type	Default	Saved	Description
0x6000	0x00	u8, ro	2	-	**Digital Inputs**, TPDO1: Number of entries.
	0x01	u8, ro	0	No	Digital Inputs**:** Ports 1 – 8, TPDO1 Bit 0 – Port 1 Bit 1 – Port 2 Bit 2 – Port 3 Bit 3 – Port 4 Bit 4 – Port 5 Bit 5 – Port 6 Bit 6 – Port 7 Bit 7 – Port 8 Each bit is only used when the corresponding port is configured as Digital Input.
	0x02	u8, ro	0	No	**Digital Inputs:** Ports 9 – 14, TPDO1 Bit 0 – Port 9 Bit 1 – Port 10 Bit 2 – Port 11 Bit 3 – Port 12 Bit 4 – Port 13 Bit 5 – Port 14 Each bit is only used when the corresponding port is configured as Digital Input.
0x6200	0x00	u8, ro	1	-	**Digital Outputs**, RPDO1 **:** Number of entries.
	0x01	u8, rw	0	No	Digital Outputs: Ports 1 – 8, RPDO1 Bit 0 – Port 1 Bit 1 – Port 2 Bit 2 – Port 3 Bit 3 – Port 4 Bit 4 – Port 5 Bit 5 – Port 6 Bit 6 – Port 7 Bit 7 – Port 8 Each bit is only used when the corresponding port is configured as a Digital Output.
0x6401	0x00	u8, ro	14	-	**Read analogue input 16-bit**, (Voltage, Current, Encoder or Frequency) , TPDO2, TPDO3, TPDO4 : Number of entries.
	0x01	s16, ro	0	No	Analog Input port 1, TPDO2
	0x02	s16, ro	0	No	Analog Input port 2, TPDO2
	0x03	s16, ro	0	No	Analog Input port 3, TPDO2
	0x04	s16, ro	0	No	Analog Input port 4, TPDO2
	0x05	s16, ro	0	No	Analog Input port 5, TPDO3
	0x06	s16, ro	0	No	Analog Input port 6, TPDO3
	0x07	s16, ro	0	No	Analog Input port 7, TPDO3
	0x08	s16, ro	0	No	Analog Input port 8, TPDO3
	0x09	s16, ro	0	No	Analog Input port 9 (Not applicable)
	0x0A	s16, ro	0	No	Analog Input port 10 (Not applicable)
	0x0B	s16, ro	0	No	Analog Input port 11 (Not applicable)
	0x0C	s16, ro	0	No	Analog Input port 12 (Not applicable)

Each sub-index is only valid when the corresponding port is configured as an Analog Input, (Voltage 0-10V, Voltage 0-32V, Current, Encoder or Frequency). For encoder inputs the value must be read as the combined value from both inputs used. Voltage values are in mV, current in uA. Frequency is in Hz and encoder in steps.

	0x0D	s16, ro	0	No	Analog Input port 13, TPDO4
	0x0E	s16, ro	0	No	Analog Input port 14, TPDO4
0x6411	0x00	u8, ro	8	-	**Write Analog Outputs 1-8.** , RPDO2, RPDO3 Values are in 0.1% steps for PWM, in mA for PWMi.
	0x01	s16, rw	0	No	Analog Output port 1, RPDO2
	0x02	s16, rw	0	No	Analog Output port 2, RPDO2
	0x03	s16, rw	0	No	Analog Output port 3, RPDO2
	0x04	s16, rw	0	No	Analog Output port 4, RPDO2
	0x05	s16, rw	0	No	Analog Output port 5, RPDO3
	0x06	s16, rw	0	No	Analog Output port 6, RPDO3
	0x07	s16, rw	0	No	Analog Output port 7, RPDO3
	0x08	s16, rw	0	No	Analog Output port 8, RPDO3

Known limitations of the CrossFire™ IX

The 1.0 release for the CrossFire IX has the following known limitations

- If node sets itself to pre-op due to a life guarding event, it is possible to set node to operational again without life guarding event being reset
- Soft start for digital outputs are only intended for test purposes

Technical Support

Contact your reseller or supplier for help with possible problems with your CrossFire™ IX. In order to get the best help, you should have access to your CrossFire™ IX and be prepared with the following information before you contact support.

- Part number and serial number of the unit, which you find on the brand label
- Date of purchase, which is found on the invoice
- The conditions and circumstances under which the problem arises
- LED indicator colors and blink patterns.
- EMCY object error codes (if possible)
- Description of external equipment which is connected to the CrossFire™ IX

Trade Mark, etc.